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COMMENTS ON THE WORKING GROUP REPORT

Public comment has been requested on the Working Group Report - Assessment of Health Effects from Exposure to Power-Line Frequency Electric and Magnetic Fields.

I have previously recommended to the NIEHS that the mandate of the EMF-RAPID Program be expanded to include radiofrequency radiation because that is now the greatest cause of injury to the public health "resulting from the production and distribution of electricity." The working group report therefore does not fulfill the request from Congress since only 60 Hz electric and magnetic fields are considered. Indeed, power line radiation by itself consists not only of 50 or 60 Hz waves, but also harmonics of 50 or 60 Hz extending well into radio frequencies, and there is no practical way to separately determine the health effects of 50 or 60 Hz only. The distinction is artificial and unrealistic.

It is also the case that the two groups of researchers most directly concerned with the effects of radiofrequency

radiation on human health and with the effects of power line radiation on human health have been sharing information for the past few years, and the types of effects seen in both syndromes are largely the same. The Cellular Phone Taskforce has been monitoring the public health effects of a massive worldwide buildout of dozens of kinds of wireless communication services exposing people to radiofrequency and microwave radiation. The Electromagnetics Research Foundation, on the other hand, has monitored the health of farm families and their animals as a result of what is usually called "stray voltage" at power line frequencies. The Electrical Sensitivity Network, now three years old, represents people injured by a wide spectrum of electromagnetic energies. We are all seeing the same kinds of illnesses--largely neurological and cardiac, but affecting all organ systems in their functioning.


While most of the scientific studies that NIEHS has reviewed are concerned only with long term effects like cancer and have laboratory animals as subjects, we represent the people whose health all of those studies are really designed to find out about, because we are the ones who are keeling over in the streets by the thousands, who are in many cases dying, not of cancer but of pneumonia, heart disease and cerebral hemorrhage, and who constitute a growing class of environmental refugees, unable to live in our own homes because of electromagnetic radiation. The gap between the Working Group Report and reality is ludicrous.

I note that the Working Group Report entirely omitted to mention the extremely serious problem of stray voltage on dairy

farms, despite extensive research already in the possession of NIEHS. Enclosed is a report recently submitted by physicist Dr. Duane A. Dahlberg, on the subject of earth currents and dairy cows, to the Minnesota Public Utilities Commission, which is similarly ignoring this widespread problem. I understand that Dr. Dahlberg has previously sent you his 125-page book, Electromagnetics Ecology: Stray Voltage in the Dairy Industry, published by The Electromagnetics Research Foundation.

The Working Group Report did review the phenomenon of electromagnetic hypersensitivity, but this review is inadequate. There are two comprehensive books on electromagnetic hypersensitivity which have been published. One is reviewed in the Working Group Report (Bergqvist and Vogel 1997). This book contains an excellent review of the literature on this subject in Appendix 3, which overwhelmingly substantiates and documents the reality of this illness, and the hazard of electromagnetic fields. Enclosed is my review of this book, in which I point out the authors' biases and their gross distortion of the results of their own survey.

The second book on electromagnetic hypersensitivity is Lucinda Grant's Electrical Sensitivity Handbook, 1995, which describes the disease in much more detail and is essential for a complete understanding of it. This book was not reviewed by NIEHS and should therefore be evaluated and included in the Report to Congress under preparation.


Arthur Firstenberg
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RESPONSE TO:
FINAL REPORT OF THE SCIENCE ADVISORS TO THE MINNESOTA PUBLIC UTILITIES
COMMISSION

FROM
THE ELECTROMAGNETICS RESEARCH FOUNDATION, INC.
Duane A. Dahlberg, Ph.D., Consultant
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ABSTRACT

The team of science advisors was charged by the Minnesota Legislature with investigating the origin of electric currents reaching dairy barns by means of earth paths and determining whether or not these currents are adversely affecting dairy cows. After three and one-half years of study, the team presented three findings, none of which answered the concerns of dairy operators dealing with stray voltage.

The first team finding seems to totally ignore the information provided by the dairy operators, and it is not supported in the body of the report. The second finding, based on the first, is contradicted by the action of Michigan's Attorney General requiring the Michigan Public Service Commission to stipulate that Consumers Energy change their distribution system. The third finding suggests that the cause of all problems on dairy farms is the operator's management skills. The same conclusion has been drawn in the past by those involved in stray voltage research when their research results were the same as the first finding of this report. Whenever the research models have not matched the stray voltage effects documented by field investigators, the problems are relegated to management. Management is always a safe finding, because all dairy operators understand that if every other aspect of dairy operations is the same, the best management produces the highest productivity.

Dairy operators who provided information to the science advisors find nothing in this report that is new or helpful. The entire three and one half year effort was simply the recycling of old research paradigms, and the information provided by the dairy operators and their consultants was apparently ignored. In addition the legislative mandate was not directly addressed; that is, to determine the origin of electric currents reaching dairy barns by means of earth paths and whether or not these currents are adversely affecting dairy cows.

RESPONSE TO FINDINGS

The findings are:

1. "We have not found credible scientific evidence to verify the specific claim that currents in the earth or associated electrical parameters such as voltages, magnetic fields and electric fields, are causes of poor health and milk production in dairy herds."
2. "At the present time, there is no basis for altering the PUC-approved standards by which electric utilities distribute power onto or in the vicinity of individual dairy farms."
3. "There are many well-documented non-electrical factors that are known and accepted by the scientific community, and by most farmers as well, to cause dairy cow health and production problems. Among the most noteworthy factors are poor nutrition, poor cow comfort and hygiene, and low or no use of vaccinations and related preventive veterinary practices. These factors should always be addressed by those who want to improve performance of dairy herds."

RESPONSE TO FINDING NUMBER 1

A very interesting phrase in these findings is “no credible scientific evidence”. It is easy to avoid confronting an issue by hiding behind these words. The use of the word “no” implies that those making this statement have all scientific information related to this problem. However evidence abounds relating behavioral, health and production problems on dairy farms to electrical sources. Whether it is considered credible and scientific is a perception issue. TERF cannot believe that a credible group of scientists could justify such a statement when evidence from dairy farms does not support such a conclusion.

The science advisors expressed the belief that stray voltage has been shown to affect dairy cows, but the source of this electricity is not in the earth. The model used here is based on the “shock effect.” The shock effect implies that for health and production effects to occur for the dairy cow, the cow must first show a behavioral response. If no behavioral response is noted when the cow is exposed to electricity, no other effects are possible. It is unclear where this concept comes from, because it rules out any possibility that electricity entering the body of the animal can disrupt the functioning of its electrical systems. Cow contact currents, produced when a cow standing on the barn floor touches another conducting part of the barn, can cause a cow to respond, and this response clearly is an indicator that the cow is aware of the electricity. It is not scientifically justifiable, however, to assume that this response is a necessary condition for electricity to cause health and production effects.

The scientific evidence upon which this first finding is based is drawn from research that assumes the shock model and does not consider possible effects from continuous exposure to low level currents. When animals are continuously exposed to electricity, it is difficult to determine whether behavioral responses are caused by the electrical exposure or some other stressor in the environment. When they are intermittently shocked, however, the response is more easily correlated with the time of the shock. For some time TERF has been aware that scientific evidence from research conducted on dairy cows has not dealt with health and production effects from low level electric currents. Experience of the dairy operators and the evidence they have accumulated point to a need for appropriate research that does not preclude effects from continuous low levels of electricity and does not use physical response as the determining factor for effect. The dairy operators had hoped that the science team would address this issue, but they did not do so.

Earth currents, which the science advisors were supposed to investigate, most frequently cause the cows to be exposed to a continuous low level current. For some reason the science advisors considered these earth currents to be totally different from currents reaching the cows by means of contacting a conductor, such as the water cup, which can cause the cow to be shocked. The science advisors accepted the possibility that cows are affected when cow contact voltages reach a certain level, although there is actually no evidence from measurements made on dairy farms that cow contact voltages are correlated with the behavioral, health, and production problems. At the same time, however, high cow contact voltages may be an indicator of electrical exposure in the cows’ environment, and by reducing it, an improvement may be noted in the behavior, health, and production of the cows. The evidence of these problems being correlated with ground faults (electrical currents going into the earth from a defective wire) is very strong. The evidence is so overwhelming, in fact, that special care is taken to avoid ground faults, and when a problem develops on a dairy farm where electricity is suspected, the first measurement made is to check for a ground fault. In a ground fault the current goes into the ground on the farm or on a nearby farm, goes through the earth to the cow and through the cow in its path back to the neutral. Dairy operators are puzzled when scientists feel a need to separate the effects caused by electric currents

from ground faults from those caused by electricity reaching the cows through the earth, perhaps from the primary grounding. The cows have not shown different behavioral, health and production effects from ground fault electric currents than they do from currents reaching them from other sources, such as the electric utility grounding. The implication of the first finding in this report is either that electrical currents do not affect dairy cows or that currents in the earth resulting from the design of the electrical distribution system are different from other currents in the cows' environment. This concept is very confusing.

The science advisors prepared a field study of 19 dairy farms, the purpose of which was to determine whether there was sufficient electricity in the environment of the dairy cows to cause the behavioral, health and production problems observed by the dairy operators. Five scientifically known hypotheses, or mechanisms, were selected for the study. Three of these mechanisms were based on the shock model. The shock model described previously is very simplistic and appears to have little relevance to the observed problems. Another hypothesis is based on a possible synergistic effect of the 60 Hz and the DC magnetic fields. This hypothesis dealing with effects on humans was not well accepted in the NIEHS RAPID meetings. A fifth hypothesis is based on possible effects from external electrical energy introducing electric fields within living organisms, based on research involving smaller animals such as rats or mice. In this study the electric fields were considered to be caused by continuous small currents in the cow. The general assumption in the field study was that if the cows are affected by electricity, the fields or currents related to at least one of the five mechanisms or hypotheses had to be above the threshold value. If none were above the threshold value, the study could not support a conclusion that electricity was affecting the cows. This approach can certainly be a valid approach when investigating effects on inanimate objects, but it is quite inappropriate when investigating effects on living things. The functioning of living systems involves far too many variables to fit into such a small box. TERF claims that this approach is illogical; dairy operators find it hard to believe that their dairy cows can be affected by electricity only if a scientific mechanism or model can be established to explain the observed effects. Cows do not wait until a scientific mechanism has been established before they allow themselves be affected by electricity. They are either affected or not affected.

This study does not take into account the fact that effects of electricity on living organism are not likely to be limited to a single measurement made by a single meter. Meters are designed to measure specific parameters under specific conditions, and the readings of the meters may or may not individually correlate with the many effects possible. The cows do not first determine the origin of the electricity before deciding whether or not they should be affected by it. They simply respond to what they feel. Neither can the cows necessarily distinguish all of the sources of electricity that reach their bodies. For example, electric currents can enter the cow by means of relative potentials at two points in the floor of the barn, through connection to the milk line, by making contact with the water cup, through capacitive coupling because of electric fields, and by means of magnetic induction from magnetic fields. It is likely that the entire EM environment of the COW is involved in the interaction of EM energy with the cow. A single hypothesis or a single measurement is an extremely crude model for predicting how electricity in the barn is affecting the cows.

The conclusions of the study rule out all but one of the hypotheses, either because no research is known that considers possible effects from the electrical or magnetic parameter associated with the hypothesis, or because results of existing research, based solely on behavioral response, are negative at levels measured in the barn. In general 60 Hz magnetic fields are quite low in dairy barns, thus ruling out this hypothesis. Three of the hypotheses were based on the concept of shock. As mentioned previously, shock is not an appropriate mechanism for explaining health and production effects. Rarely do barns have conditions that lead to shock effects. When they do, the situation is quickly corrected.

The only hypothesis that had any chance of revealing a connection to electricity was the electric field in the cow produced by currents from step potentials. Step potentials exceeding the threshold established by the science advisors were found in the test barns, but the team concluded that there was not enough information to extrapolate to dairy cows. They set a threshold for potential effects and then explained it away after finding that the threshold was exceeded. The step potentials averaged 4.2 times higher in the low producing herds (LHP) than in the high producing herds (HHP). This difference in step potentials reveals that the electric fields in the low producing cows on the average were 4.2 times higher than those in the high producing cows. Such a discovery should have also been included in the findings, rather than buried in the body of the report.

RESPONSE TO FINDING NUMBER 2

In April 1998, Michigan's Attorney General Frank J. Kelly filed a complaint against Consumers Energy over the damage done to Michigan's agriculture industry because of stray voltage. The complaint was filed with the Public Service Commission (PSC).

A news release from his office states:

Stray voltage occurs most often when electricity which is designed to travel over neutral wires instead uses the path of least resistance and moves into the ground. It is particularly troublesome to cows on dairy farms. Stray voltage has been linked directly and indirectly to reduction in milk production; stillborn calves; birth defects in livestock; and erratic behavior in livestock.

Kelly said: "Consumers' record with its rural customers, especially farmers, is abysmal. Over one-third of the dairy farms in Michigan have been driven out of business due in part to stray voltage."

In the complaint, Kelley states that Consumers' rural electric distribution system is wholly inadequate and has not been upgraded in decades. The complaint notes that Consumers had paid millions of dollars in ratepayer funds for settlements and judgments in private lawsuits over damages caused by stray voltage. The PSC is being asked to issue an order requiring Consumers to upgrade its electric distribution system.

Kelly stated: "I find it ironic that Consumers often touts research, that the company paid for, stating that there is no real problem on dairy farms with stray voltage. It reminds me of the same convoluted research done by the tobacco industry to show that smoking does not adversely affect a person's health. Just as the facts show the harmful impact of tobacco, the same can be said of the damage being done by stray voltage."

The Michigan Attorney General's complaint states that the currents in the earth are the major source of stray voltage on dairy farms. This information is exactly the same as that provided to the science advisors by TERF and the dairy operators.

RESPONSE TO FINDING NUMBER 3

The legislation enacted in Minnesota set up a team of science advisors to work closely with dairy farmers experiencing specific problems, in order to provide answers to the behavioral, health, and production problems on many dairy farms. TERF was contracted by the MN Department of Public

Services to provide information to the science advisors, with a focus on information from dairy operators and their consultants. Central in all of this information is the fact that dairy farmers are well aware of the need for good management practices, but no one has been able to find any management improvement capable of solving the behavior, health, and production problems on many dairy farms in Minnesota and other states in the country. TERF provided information from over a hundred of these farms, delineating the problem and describing some of the individual efforts for improving dairy operations. Most interesting is the continual cry of the dairy operators that every recommended best management practice is applied before electrical causes are examined. Experts are consulted to ensure the greatest possibility of finding a cause and implementing a solution. It is when those efforts fail and the retained experts in management issues are unable to find management solutions to the problems experienced on the farm, that the operator is told to consider stray voltage as the cause. Usually electricity is the final factor to be considered. Stray voltage is probably the most complex and insidious problem that a dairy farmer will ever encounter. Experiencing stray voltage is literally a curse for the dairy operators. A dairy operation known to have a stray voltage problem can lose its economic viability; equipment and operating loans are almost impossible to obtain. It would be easier and frequently wiser economically to sell the dairy operation rather than even consider the possibility that stray voltage is the problem.

In addition to background on farmers' experiences, TERF offered a model which is supported by such scientists as Bjorn Nordenstrom from Sweden and Robert Becker from the United States. This model begins with the known fact that electric currents are necessary ingredients in all living organisms. As appropriate chemical balances are necessary for good health so are appropriate electric currents. This model suggests that any interference in these electric currents caused by external electric fields or currents can affect health.

It appears that the science advisors chose not to take seriously the work of dairy operators and their consultants, or the model TERF proposed. The fact that the science team included finding number three suggests that they chose to begin where dairy operators had begun early in their analyses of the problems. Unfortunately, the science advisors never reached the point in their analysis to be able recognize or accept the possible electrical contribution. They did not spend sufficient time on dairy farms to experience the changes in the behavior, health, and production of dairy cows when electrical changes were made, especially those changes that affect the amount of electricity going into the earth on the grounding systems. Consequently they settled for a determination of the possibility of effects based on known scientific models. Since the only available model that could have been used to explain the health and production effects was not mentioned in the findings, the science advisors apparently had no choice but to conclude that electricity was not causing the problem; poor management was at fault.

GENERAL OBSERVATIONS

In performing the statistical analyses, a decision was made to use one effect parameter, milk production, with which to correlate non health parameters. When asked why somatic cell count (SCC) or other effects were not considered in the correlations, the response was that these factors were used in selecting the two sets of farms and therefore would provide biased information. Milk production was the main criterion for selecting the two sets of farms. For some unknown reason to TERF, using milk production as the correlating factor mysteriously avoided the expected bias. TERF and all dairy farmers who testified attempted to make it clear that there can be a number of behavior, health, and production effects on a dairy farm where electricity has been found to be the cause. In addition, the most serious effect or effects are not necessarily the same on all farms. Thus by targeting one effect such as low milk production, the inverse correlation with electrical parameters is likely to be statistically significant only for those farms where low milk production is the primary effect.

It is interesting to note the guidelines used in choosing the HHP and the LHP herds, and how well the two groups fit each of the criteria. The guidelines involved milk production, SCC, mortality rate, culling rate, and dairy operators' perception of significance of the 26 clinical signs. To be selected, a farm had to meet three of the five guidelines as specified in the report. When the data on the farms were collected, the average rolling herd average was 20,500 HHF and 14,000 LHR, SCC was 319,000 HHP and 413,000 LHP, culling rate was 34.5 % HHP and 28.3% LHP, death rate was 3.7% HHP and 5.9% LHP, and the information on the comparison for the 26 clinical signs was not provided. The only criterion that was statistically significant is milk production. In addition some individual cow data were provided: In the HHP the cows were taller, heavier, younger, younger at first breeding, had higher body condition scores, and had shorter calving intervals. All of these factors were statistically significant.

Dairy operators experiencing stray voltage problems find this information in accordance with their experience. To maintain higher milk production and reduce mortality rate, it is necessary to replace cows more frequently. SCC can be but is not necessarily a good predictor of the level of stray voltage. SCC does not necessarily correspond to the comfort index used in this study. Information about the size and the weight of the cows, as well as the time of first breeding, are also in line with farmer expectations because of the slower growth and the difficulty of maintaining the weight of dairy animals on stray voltage farms. It is unfortunate that milk production was the only parameter to which correlations were made. Since there was no statistical significance for the other criteria used in selecting the dairy farms, the degree to which electricity was affecting the cows in these herds is not necessarily related to whether the farms are in the HHP or the LHP. There is only a greater probability that the HHP are experiencing fewer effects from electricity than the LHP. Thus, in recognition of the small sample size, statistical significance in correlating specific electrical conditions only to milk production is unlikely, even when a correlation between level of electrical exposure in the dairy barn and behavior, health, and production effects is very significant.

Throughout the report consideration of non-electrical parameters primarily focused on farm operator management, with little attention devoted to behavior, health and production problems on the farms. No comparison is made between these aspects of a HHP dairy operation and a LHP dairy operation. Yet these are the factors that prevent the dairy operator from having a profitable operation. Dairy operators know that on an even playing field, the best managers will show the greatest profitability. The purpose of this study should have been to find out how electrical exposure on the dairy farm distorts the playing field.

This report had a concluding section on electrical inspection but there was no indication of differences in "hazardous electrical conditions" of the HHP and the LHP farms. In addition there was no attempt to correlate electrical problems which could increase current going into the ground with milk production or other cattle criteria. Why was this considered such an important part of the project when there was no indication of what role this might play in milk production or other factors?

In the conclusions regarding sources of ground currents, no measurements were made to determine what fractions of the step potentials in the stalls were due to the farm electrical system and what fractions were from off farm sources. Instead earth surface conductivities were measured, and earth currents were calculated from the measurement of step potentials between ground rods. It was apparently assumed that the rods driven into the earth to measure step potentials measured the true IR drop in the earth between those two points. In addition it was assumed that the currents that reach the barn from off-farm sources travel along the surface of the earth. None of these assumptions are necessarily valid.

by the authors, is consistent with reports in the literature noting a rise in cholesterol following exposure to electromagnetic radiation (see Klimkova-Deutschova 1974 and Sadchikova 1980, cited in Exhibit 'A'). In the Andersson study, subjects given psychological therapy would have been less likely to avoid exposure, and would therefore have increased their exposure during the duration of the study, which would have caused their cholesterol to rise. I beg to refer to a copy of the Andersson (1996) study, upon which, marked with the letters "AFS 9", I have signed my name prior to the swearing hereof.



N. The extensive review of the literature by Bergqvist and Vogel (1997) also does not support the authors' conclusions. On page 5, they admit, "it has to be acknowledged that there are people with health problems of unknown origin that might become so severe that they quit their workplace and even change their entire life and move from their home in cities to rural areas." Again on page 13: "Some patients, however, report intolerable symptoms, most commonly pain or severe, paralyzing fatigue if they do not avoid the vicinity of electromagnetic field sources." On page 13, the fact that not everybody has developed electrical sensitivity is wrongly given as a reason to doubt the effects of electromagnetic fields. For the entire population to succumb at once--whether it be to air pollution or lead or tobacco or asbestos or a virus or bacteria or ionizing or nonionizing radiation--is virtually unheard of in medicine. There is always a wide range of susceptibility. On page 14, the authors make the unfounded assumption that patients with these symptoms "usually have heard of electromagnetic hypersensitivity." Quite the contrary: most often they have suffered alone, sometimes for years, before they heard of electrical sensitivity for the first time and were relieved to know there were others with the same problem. On page 15, the case of P.S., who lives in an iron-sheeted room, is described.

p.S. is an individual I know personally, and his electrical sensitivity is quite real. It happens that since the introduction of digital high-frequency cellular service, his iron-sheeted room is no longer adequate, because it is protective only up to about 100 MHz.

In the summary on pages 16-20 the authors admit the existence of some biological effects: EEG changes, melatonin reduction, seborrheic eczema, non-specific erythema, alterations in prolactin and thyroxin levels. The actual studies reviewed in Appendix 3 are much more revealing. In every category of research they review, without exception, at least half, and usually the majority of the researchers report positive findings: 5 of 7 groups of investigators found a correlation between electromagnetic fields and depression, neurasthenia or similar symptoms; 3 of 4 researchers found a link between electromagnetic fields and suicide; 4 of 5 rodent studies showed a decrease in melatonin; 2 of 3 human studies showed an effect on melatonin and circadian rhythms; 4 of 7 researchers showed an effect on EEGs or ECGs; 2 of 2 studies showed an effect of mobile phones on EEGs and/or sleep; 11 of 13 reports correlated video display units with dermatitis; 11 of 13 epidemiological studies found skin disorders were related to video display units; 5 of 6 researchers found a link between skin problems and electromagnetic fields, and the only negative studies were done by Bergqvist himself; in electrically sensitive subjects, 3 of 4 researchers found effects on hormone levels; 3 of 3 found objective histopathological changes in the skin; 1 of 2 found effects on skin temperature; 6 of 12 provocation studies had positive or partly positive results; 3 of 5 researchers found decreased melatonin or increased light sensitivity.

The authors' biases are evident. They even appear to adopt the ludicrous position that even such effects as "heat or pain... can be considered 'physiological' rather than 'adverse'" (Appendix 3.13). This book is full of negative interpretations

of a literature survey that overwhelmingly indicates both the adverse impact of electromagnetic radiation on the average person's health and the existence of a segment of the population that is hypersensitive to electromagnetic radiation, including radiofrequency radiation such as is emitted by cellular phone transmitting antennas. I beg to refer to a copy of the Bergqvist and Vogel (1997) study, upon which, marked with the letters "AFS 10", I have signed my name prior to the swearing hereof.

0. The same author, Bergqvist, in a non-peer-reviewed setting, is the source of Drs. Bailey and Erdreich's conclusions about the shortwave transmitter near Berne, Switzerland (their Report, paragraph 14). This shortwave transmitter at Schwarzenburg was the subject of an official epidemiological study commissioned by the Swiss government in response to continued health complaints over a 20-year period by the residents of the surrounding community (Altpeter et al. 1995). The complaints are identical to those being reported from all over the world to the Cellular Phone Taskforce: insomnia, weakness, nervousness, joint and limb pain, disturbed concentration, heart palpitations, cough and sputum, shortness of breath, headache, dizziness, etc. The leader of the study, Theodor Abelin, is a medical doctor and the Head of the Department of Social and Preventive Medicine at the University of Berne. The 404 people who participated in this study underwent a health interview and personality tests, and kept health diaries during the summers of 1992 and 1993. Blood pressure and urine melatonin levels were also measured.

The results of this study, as Dr. Josef Mayr pointed out in the September/October issue of Microwave News, are sensational. Insomnia, nervousness and restlessness, limb and joint pain, general weakness and tiredness, cough and sputum, and abnormal blood pressure were found to be more frequent within 1.5 kilometers of the transmitter. Sleep